

CASE 4:

Modeling heat load in a district heating system

Background

In Denmark a considerable number of houses are connected to a district heating system. In a district heating system several production units may exist, and for the considered district heating system this is indeed the case. The production cost varies from production unit to production unit – the cheapest is often a waste incinerator plant. The varying consumption of heat means that some units need to be started or stopped. A startup of a larger heat production unit may take several hours. Hence it is beneficial to be able to predict the heat consumption. This calls ultimately for a dynamical model for the heat load.

VEKS supplies heat and hot water to the equivalent of 150,000 families.

For a more detailed description of VEKS we refer to the home-page of VEKS:

`www.veks.dk`

Note that an English version is directly available.

Purpose

The purpose of this case study is to investigate time series of measured heat production in the VEKS district heating system, and to establish models for predicting the heat consumption.

The data

The data originates from VEKS (Vest-Egnens Kraftvarme System), which delivers heat to a part of Copenhagen. One year of hourly measurements of the heat

consumption, climate variables, etc. are found in the file:

`veks.csv`

A further description of the data and the data format is found in the file:

`veks.exp.variables`

The meteorological data originates from a climate measurement station called Højbakkegaard in Tåstrup. The meteorological data can be assumed to be representative for the climate data in the entire VEKS area. Also the meteorological data is further described in the above mentioned file.

The file also contains some summary information which can be very useful in checking that you consider the correct data.

The raw data did contain both outliers and missing data. In order to accommodate the calculations we have established a 'clean' data set (*.f - files), and we suggest that you use these data.

Part 1:

In part a static model for the heat consumption shall be formulated.

Part 2:

In this part a dynamic model, either parametric or non-parametric, for the heat consumption shall be formulated.

Hint: It might be useful to consider the district heating system as one (obviously huge) building.